



Report on international efforts in research, monitoring and capacity building in the field of marine and coastal biological diversity

Salvatore Aricò

Ocean Science in Relation to Living Resources Programme, Intergovernmental
Oceanographic Commission of UNESCO, 1 rue Miollis, 75732 Paris Cedex 15, France

ABSTRACT

Nowadays the issue of marine and coastal biodiversity extends well beyond the historical diversity concept, which dealt with the measurement of the richness (in terms of species) within a certain natural community (ensemble of natural populations, where each population is composed by individuals belonging to the same species) or within a certain area. Indices were used, some of which also dealt with the ecological components of diversity, such as the evenness index, which measures whether species diversity also corresponds to differences in the distribution of the number of individuals within each species, thus measuring the ecological significance of diversity. The Convention on Biological Diversity defines biological diversity as 'the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems'.¹ Copyright © 1996 Elsevier Science Ltd.

The concept of biodiversity ranges from traditional studies on species to present systematics (the study of rules and procedures to classify living organisms) and employs new approaches such as molecular tools and genome genetics. This concept also implies a renewed importance of the need to understand the role of biodiversity with respect to ecosystem function,² thus going far beyond the historical concept of diversity.

From a conservation perspective, mitigation of habitat reduction and loss seems to be a key question, due to the effects of human activities on natural systems,³ of which genetic and, more generally biological

diversity is part. However, anthropogenic effects on biodiversity might not be clearly distinguished from the natural variability in species, populations and ecosystems.⁴

The 3-dimensional nature of the ocean space and the fact that the major part of that space is beyond the reach of direct observation require a fundamentally different approach to studies of biological diversity in the marine environment than in the terrestrial one. The marine habitat, covering more than 70% of the earth's surface and extending from sea level to more than 10,000 m depth is also unique in the diversity of its living organisms as well as ecosystems. Of 33 existing phyla (the highest taxonomic groups after kingdoms), 32 occur in the marine environment, and 15 phyla are exclusively marine.

The Convention on Biological Diversity, first opened for signature at the United Nations Conference on Environment and Development (UNCED) in Rio, 1992 (the 'Earth Summit') and, as of 4 January 1996, ratified by 138 countries, represents the major international institutional framework for biodiversity conservation and sustainable use. At the First Conference of the Parties (COP) of the Convention, which took place in Nassau, Bahamas, in 1994, a Medium Programme of Work for the COP for the period 1995–97 was endorsed, including an item on conservation and sustainable use of coastal and marine biodiversity.⁵ On that occasion, it was also decided that the Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA) to the Convention should deal with the above-mentioned issue and make related recommendations to the Second Conference of the Parties (COP-II) (subsequently held in Jakarta, Indonesia in 1995).

The text of the Convention refers to global biological diversity, without mentioning specifically the marine or other environments. The Convention mainly focuses on the recognition of the vital importance of earth's biological resources for humanity's economy and social development and that 'biological diversity is a global asset of tremendous value to present and future generations'.¹ At COP-I, several Delegations stressed the enormous importance of marine and coastal biological diversity and that it was timely for the Conference of the Parties to consider how to best address this issue. This is understandable in light of the importance of marine living resources for coastal countries, in tropical and developing regions above all, for which the marine environment represents a source of income in terms of production of food, cosmetics and drugs, as well as in terms of tourism. The priorities of coastal countries and small islands states range from the mitigation of the effects of harmful algal blooms to sustainable fisheries, habitat degradation, and so on. Therefore, the issue of marine and coastal

marine biodiversity is being treated in the Convention context in a comprehensive manner, encompassing all the different aspects of the problem and also taking into account the use of traditional knowledge and practices, since local cultures and social habits are important factors in environmental management.

SBSTTA had its First Meeting at UNESCO, Paris, in September 1995, prior to COP-II. Several issues related to coastal and marine biodiversity were dealt with, ranging from the introduction of alien species to fishery-related matters. One of the most important conclusions was that habitat preservation is needed in order to conserve marine biological diversity. Another important point which was made was that the role of biodiversity in ecosystem functioning should be taken into account while carrying out biodiversity studies. It was agreed that integrated coastal area management (ICAM) represents a tool to address the issue of biodiversity conservation and rational use, and that this practice should be adopted at large.⁶

The importance of an integrated approach in research related to biodiversity is obvious, due to the need to consider the different aspects of the problem. The DIVERSITAS Programme (an initiative of the International Union of Biological Sciences (IUBS), presently co-sponsored by the Scientific Committee on Problems of the Environment (SCOPE), the core-project on Global Change and Terrestrial Ecosystems (GCTE) of the International Geosphere-Biosphere Programme (IGBP), the International Union of Microbial Societies (IUMS) and the United Nations Educational, Scientific and Cultural Organization (UNESCO)) provides the research framework necessary to address scientific aspects of biodiversity. Five core programme elements focusing on key areas of biodiversity research have been established: (i) biodiversity and ecosystem functioning; (ii) origin, maintenance and change; (iii) systematics, inventorying and classification; (iv) monitoring of biodiversity; and, (v) conservation, restoration and sustainable use. Correspondingly, four Special Target Areas of Research (STAR) have been identified, namely soil and sediments, marine biodiversity, microbial diversity and human dimension of biodiversity.⁷ DIVERSITAS is intended to act as a facilitating mechanism for the design, launching and implementation of research projects on biological diversity, including at the national level, as well as for the dissemination of results. The idea is to achieve the above objectives through the production of manuals on methodologies, the organization of workshops and symposia for the dissemination of scientific results, etc.

Within the ecological community, there still is not a clear agreement on the role and functioning of biological diversity. Ecologists cannot

state precisely the degree of biological diversity present in the oceans and coastal zones, nor the rates of biodiversity reduction (or of new biodiversity generation). The only thing that ecologists seem to agree on is that habitats are being dramatically reduced, which leads one to think that the biological diversity which is hosted by those habitats is in danger. It is clear that, because of the general lack of knowledge on these questions, research efforts must be undertaken. They also have to be sustained over time, since it may take a long time before we start having a sufficiently clear picture of the overall situation.

The recognition of DIVERSITAS as the major comprehensive international research programme on biodiversity is increasing. However, it will still take some time before countries will be able to carry out national research programmes and activities contributing to DIVERSITAS, due to the time needed for their design, development and launch, but also to the lack of a funding mechanism for the Programme. This exercise, as well as all the major research programmes which are concerned directly, e.g., the Global Investigation of Marine Pollution in the Marine Environment, or indirectly, such as the World Climate Research Programme, should be linked to the Convention on Biological Diversity, for which a funding mechanism exists (the Global Environmental Facility — GEF), including for the activities under Article 12 'Research and Training' of the Convention.

Marine and coastal biodiversity needs to be monitored, as specifically called for in the Convention on Biological Diversity. Article 7 'Identification and Monitoring' calls on Contracting Parties to, *inter alia*, 'monitor, through sampling and other techniques, the components of biological diversity [important for its conservation and sustainable use having regard to the indicative list of categories set down in Annex I*] (...), paying particular attention to those requiring urgent conservation measures and those which offer the greatest potential for sustainable use'.

The lack of specific monitoring systems, which would focus not only

* Annex I to the Convention on identification and monitoring states: 1. Ecosystems and habitats: containing high diversity, large numbers of endemic or threatened species, or wilderness; required by migratory species; of social, economic, cultural or scientific importance; or, which are representative, unique or associated with key evolutionary or other biological processes; 2. Species and communities which are: threatened, wild relatives of domesticated or cultivated species; of medicinal, agricultural or other economic value; or social, scientific or cultural importance; or, importance for research into the conservation and sustainable use of biological diversity, such as indicator species; and 3. Described genomes and genes of social, scientific or economic importance.

on biological parameters but above all on biodiversity ones, represents a major problem. It is expected that the Global Ocean Observing System (of IOC, the World Meteorological Organization and the United Nations Environment Programme) and, in particular, its Module on Living Resources (LMR) may be useful in this regard. GOOS is intended to monitor the world ocean by using existing monitoring stations and by helping establish, through cooperative actions, monitoring facilities where they do not yet exist. Its modules on climate, health of the ocean, coastal zone, ocean and marine meteorological services and living marine resources ensure also a global coverage from a topic viewpoint. The LMR Module is presently under design by a joint GOOS-Global Ocean Ecosystems Dynamics (GLOBEC, of IGBP) group of experts. As has already been done for the other activities under GOOS which have been implemented so far, particular care will be given to the standardization of methodologies, for the sake of data exchange and comparison.^{8,9}

The Convention on Biological Diversity calls on implementation by the Parties of the specific issues identified within each of the Articles of the Convention, where appropriate, through competent international organizations.¹ All the major intergovernmental meetings related to the Convention which have been held up to the present (First Meeting and Second Meeting of the Intergovernmental Committee to the Convention on Biological Diversity, Geneva, 1993 and Nairobi, 1994, respectively; Open-ended Intergovernmental Meeting of Scientific Experts on Biological Biodiversity, Mexico City, April 1994; COP-I; SBSTTA-I; and, COP-II) have seen the strong involvement of several international organizations, both UN entities (UNEP, UNESCO and its Intergovernmental Oceanographic Commission, FAO and others) and non-governmental organizations (IUCN and many others).

For example, as in the case of many other organizations, the issue of how the Intergovernmental Oceanographic Commission of UNESCO (IOC) should deal with coastal and marine biodiversity as well as how the Commission could relate to the Convention on Biological Diversity was discussed within the context of the IOC Governing Bodies' (the IOC Assembly and Executive Council) meetings. Specifically, the IOC Assembly, at its Eighteenth Session held in Paris in 1995,¹⁰ approved Resolution 9 on Marine Biodiversity which, *inter alia*, recognizes the great importance of conserving marine biodiversity, including the need for research in the subject area, and that IOC has a substantial role to play in providing the Conference of the Parties to the Convention on Biological Diversity, through its SBSTTA, with advice on scientific issues concerning marine biodiversity. The IOC strategy in the field of

marine biodiversity, developed by an *ad hoc* Consultation on Marine Biodiversity (Paris, 3–5 May 1995) and endorsed by the IOC Assembly, includes a major element which requires concerted international cooperation, especially aimed at building capacity in the field of marine biodiversity. The Strategy stresses that capacity building could be achieved *inter alia* through short-term training in para-taxonomy, short-term training in taxonomy and long-term high level education in taxonomy. Training, in fact, is a fourth major element in addressing the commitments that the Parties to the Convention have assumed, in addition to research, monitoring and international co-operation. IOC's expertise can also be useful in relation to specific research and monitoring issues, as identified by SBSTTA at its first meeting, for example, the identification of methodologies and research to assess the impact of land-based activities on marine biodiversity and the assessment of the effects of the introduction of harmful algal species through ballast waters.

There are several examples of issues which are presently being addressed by international organizations individually or through joint actions. One is given by the provision of tools (such as the IUBS Series 2000 Project and the UNESCO-IOC Register of Marine Organisms) to fulfil the commitment the Parties to the Convention have made towards compiling national biodiversity inventories (this is important especially in countries where scientific libraries are scarce or absent, which causes difficulties in accessing taxonomic reference texts). Some of these tools are computerized (CD-ROMs, Internet) and thus easily accessible. Other initiatives are related to conservation (e.g. the Biosphere Reserves of the Man and Biosphere Programme), financial and technical assistance (the World Bank), the input on how to integrate the intergovernmental perspective with the NGO one, provided by IUCN and other international and regional NGOs. Marine and coastal biodiversity is in fact considered by all these organizations, and priority is given to this issue. This is because the growing interest in marine and coastal biodiversity which was generated at the First Conference of the Parties to the Convention in Nassau in 1994 finds important support in Chapter 17 of the comprehensive plan of action 'Agenda 21' formulated at the Earth Summit, which deals with the protection and sustainable use of the oceans and all kinds of seas.

While all these organizations are coming together well, which reflects the international and intergovernmental nature of the Convention, it is on the development of successful nationally-driven projects that the full implementation of the Convention's objectives depends, namely the sustainable use, equitable sharing and conservation of marine genetic

resources. Capacity building and provision of assistance at the national level is thus imperative. Here lie the remaining challenges, and here the Convention will have to prove its effectiveness as an international legal instrument also aimed to reduce economical and political conflicts.

The issue of biological diversity remains scientifically challenging, even in those countries where the present knowledge already represents a substantial basis for action. However, much could be already achieved in preserving the biological diversity of the world's oceans by developing concrete initiatives on the basis of what we do presently know, while in the meantime we realize that trends in the discovery of new marine species actually indicate that many species still remain to be described.¹¹

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